IN THE UNITED STATES PATENT AND TRADEMARK OFFICE
BEFORE THE BOARD OF PATENT APPEALS AND INTERFERENCES

In re the Application of: **Shoji HARA** Group Art Unit: **1762**

Application Number: **09/782,169** Examiner: **Brian K. Talbot**

Filed: **February 14, 2001** Confirmation Number: **2107**

For: **LAMINATE COMPRISING POLYMIDE AND CONDUCTOR LAYER, MULTI-LAYER WIRING BOARD WITH THE USE OF THE SAME AND PROCESS FOR PRODUCING THE SAME**

Attorney Docket Number: **010164**
Customer Number: **38834**

SUBMISSION OF APPEAL BRIEF

Commissioner for Patents
P.O. Box 1450
Alexandria, Virginia 22313-1450

November 14, 2007

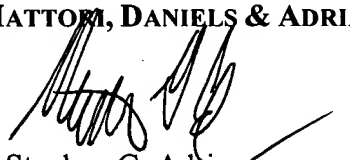
Sir:

Applicants submit herewith an Appeal Brief in the above-identified U.S. patent application.

Attached please find a check in the amount of $510.00 to cover the cost for the Appeal Brief. If any additional fees are due in connection with this submission, please charge Deposit Account No. 50-2866.

Respectfully submitted,

WESTERMAN, HATTORI, DANIELS & ADRIAN, LLP



Stephen G. Adrian
Attorney for Appellants
Registration No. 32,878
Telephone: (202) 822-1100
Facsimile: (202) 822-1111

SGA/arf

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE BOARD OF PATENT APPEALS
AND INTERFERENCES

APPEAL BRIEF FOR THE APPELLANT

Ex parte Shoji HARA et al. (Applicant)

LAMINATE COMPRISING POLYMIDE AND CONDUCTOR LAYER, MULTI-LAYER WIRING BOARD WITH THE USE OF THE SAME AND PROCESS FOR PRODUCING THE SAME

Application Number: 09/782,169

Filed: February 14, 2001

Appeal No.:

Group Art Unit: 1762

Examiner: Brian K. Talbot

Submitted by:
Stephen G. Adrian
Registration No. 32,878
Attorney for Appellants

WESTERMAN, HATTORI,
DANIELS & ADRIAN, LLP
1250 Connecticut Avenue NW, Suite 700
Washington, D.C. 20036
Tel (202) 822-1100
Fax (202) 822-1111

November 14, 2007

Appeal Brief
Attorney Docket No. **010164**
Application No. **09/782,169**

BRIEF ON APPEAL

(I) REAL PARTY IN INTEREST

The real party in interest is **KANEKA CORPORATION**, by an assignment recorded in the U. S. Patent and Trademark Office on May 21, 2001, at Reel 011827, Frame 0305.

(II) RELATED APPEALS AND INTERFERENCES

There are no other applications, patents, appeals or interferences known to appellant, appellant's legal representative, or assignee which may be related to, directly affect or be directly affected by or have a bearing on the Board's decision in the pending appeal.

(III) STATUS OF CLAIMS

Claims 1-13 and 17-20 are pending. Claims 14-16 have been canceled. Rejected claims 1-13 and 17-20 are appealed. The appealed claims appear in the appendix.

(IV) STATUS OF AMENDMENTS

No amendments have been filed subsequent to final rejection.

(V) SUMMARY OF THE CLAIMED SUBJECT MATTER

The invention is directed to processes for producing a laminate comprising a polyimide and a conductor layer. As set forth in the independent claims (described in more detailed below), the claimed processes are characterized in that at least one conductor layer is directly formed on a surface of a thermoplastic polyimide film to obtain a laminate. In other words, a conductor layer is directly formed (for example, by plating, sputtering, evaporation, CVD or ion plating), on a thermoplastic polyimide film. The claimed processes differ from methods which employ a previously formed conductor layer (a foil) which is laminated to polyimide.

As recognized in the art, polyimide films show only poor adhesion strength to conductor layers. Thus, to improve adhesion, it has been a practice to mechanically roughen the surface by sandblasting in order to enlarge the contact area of a conductor layer or to employ an undercoating layer prior to formation of a conductor layer on a polyimide film (see specification, page 2, lines 1-9). Such methods suffer various problems.

The present inventors discovered that, in a laminate wherein a metallic layer is directly formed on a thermoplastic polyimide, there has still existed a margin for the strength of the adhesive layer to increase. In other words, the present inventors discovered that the strength has not reached the maximum value yet, and that intentional heating of the laminate can give rise to an improved result.

Various techniques for forming a metallic layer directly on a thermoplastic polyimide are well known, and the resulting laminates, which have been prepared by some metallic layer

formation process depending on each application, are in practical use without serious problems. Those of ordinary skill would naturally think that the maximum adhesion strength has already been achieved. Accordingly, it is almost impossible to envisage any further treatment for adhesion enhancement.

The present inventors discovered that adhesion strength can be unexpectedly improved when a conductor layer is formed directly adhering with a thermoplastic polyimide and then subsequently heated after the laminate is formed. See the data provided in the specification and the attached declarations of Masaru Nishinaka filed on July 11, 2003 and on March 2, 2005.

Independent Claim 1

Claim 1 is directed to a process for producing a laminate comprising a polyimide and a conductor layer. The method comprises forming at least one conductor layer directly adhering to at least one surface of a thermoplastic polyimide film to obtain a laminate, and heating said laminate after said laminate is formed so that the adhesion strength between the thermoplastic polyimide film and the conductor layer is enhanced.

Thus, claim 1 requires at least one surface of a thermoplastic polyimide film upon which a conductor layer is formed directly adhering thereto. The language of claim 1 does not read on and is not intended to read on metal foils which are previously formed and then applied to a thermoplastic polyimide film. See the paragraph bridging pages 11 and 12 of the specification.

Independent Claim 2

Independent claim 2 is directed to a process for producing a laminate comprising a polyimide, a sheet material and a conductor layer. The process comprises casting or applying a polyamic acid corresponding to a thermoplastic polyimide to at least one of a sheet material surface (page 11, lines 1-9), imidating said polyamic acid to form a polyimide laminate having a thermoplastic polyimide surface (page 11, line 7-9), forming at least one conductor layer directly adhering with at least one of the thermoplastic polyimide surfaces to obtain a laminate (see paragraph bridging pages 11 and 12 of the specification), and heating said laminate so that the adhesion strength between the thermoplastic polyimide and the conductor layer is enhanced (page 12, lines 10-14). Thus, similar to claim 1, claim 2 requires the initial formation of a thermoplastic polyimide surface, followed by forming at least one conductor layer directly adhering with the thermoplastic polyimide surface, followed by heating to enhance adhesion strength.

Independent Claim 3

Independent claim 3 is directed to a process for producing a laminate comprising a polyimide, a sheet material and a conductor layer. The process of claim 3 requires attaching at least one thermoplastic film to at least one of a sheet material surface to form a polyimide laminate having thermoplastic polyimide surface(s), forming at least one conductor layer directly

adhering with at least one of the thermoplastic polyimide surfaces, and heating said laminate so that the adhesion strength between the thermoplastic polyimide and the conductor layer is enhanced. Thus, similar to claims 1 and 2, claim 3 also requires the formation of a thermoplastic polyimide surface upon which a conductor layer is formed directly adhering thereto, followed by heating so that adhesion strength between the thermoplastic polyimide and the conductor layer is enhanced.

Dependent Claim 12

Claim 12 depends from claim 10, which in turn depends from any one of claims 1 to 3. Claim 10 requires that the conductor layer is formed by a dry plating method, and claim 12 requires further increasing the total thickness of the conductor layer by a wet plating method.

Independent Claim 17

Independent claim 17 is directed to a process for producing a laminate. The process requires dry plating at least one conductor layer directly adhering with at least one surface of a thermoplastic polyimide film to obtain a laminate, and heating said laminate so that the adhesive strength between the thermoplastic polyimide film and the conductor layer is enhanced. Thus, as with the other independent claims, claim 17 requires the presence of a thermoplastic polyimide film on which a conductor layer is directly adhered thereto. Claim 17 is specific to forming the conductor layer by dry plating.

Independent Claim 18

Independent claim 18 is directed to a process producing a laminate. The process requires providing a thermoplastic polyimide film having at least one surface; forming a conductor layer directly adhering with said at least one surface; and heating the thermoplastic polyimide film and the formed conductor layer. Thus, as with the other independent claims, claim 18 requires the presence of a thermoplastic polyimide film upon which a conductor layer is formed directly adhering with at least one surface thereof. Claim 18 further requires heating the thermoplastic polyimide film and the formed conductor layer.

(VI) GROUNDS OF REJECTION TO BE REVIEWED ON APPEAL

The following rejections are presented for review.

1. Claims 1-9, 13 and 17-20 being rejected under 35 USC §103(a) as being unpatentable over Chen et al. or Shiotani et al. in combination with JP54-066966.

2. Claims 1, 3-11, 13 and 17-20 being rejected under 35 USC §103(a) as being unpatentable over JP '640 or JP '106 in combination with JP '966.

3. Claim 12 being rejected under 35 USC §103(a) as being unpatentable over JP '640, Chen et al., Shiotani et al. or JP '106 in combination with JP '966 further in combination with Ameen et al.

(VII) ARGUMENT

1. Claims 1-9, 13 and 17-20 are patentable over Chen et al. or Shiotani et al. in combination with JP54-066966.

The combination of references set forth in the rejection fails to raise a prima facie rejection of the claims because the combination does not teach all of the features required by the claims. Furthermore, the combination provides no suggestion which would render the claimed invention obvious.

Independent Claim 1

The combination of references fails to teach the features required by claim 1 with respect to forming at least one conductor layer directly adhering with at least one surface of a thermoplastic polyimide film to obtain a laminate, and heating said laminate after said laminate is formed so that the adhesion strength between the thermoplastic polyimide film and the conductor layer is enhanced.

In the final Office Action dated February 15, 2007, the Examiner applied the teachings of Chen et al. or Shiotani et al. with respect to applying a metal layer to a polyimide layer. The final Office Action acknowledged that Chen et al. and Shiotani et al. each fail to teach heating the laminate. JP '966 was applied by the Examiner for its disclosure of aging which does not result in reduced adhesion strength. The Examiner argued that it would have been obvious to modify

the teachings of Chen et al. or Shiotani et al. to perform a subsequent aging step "with the expectation of achieving a superior bond between the polyimide and the metal layers."

The Examiner's rationale for combining the references "with the expectation of achieving a superior bond between the polyimide and the metal layers" is unsupported by the teachings of the references. As argued in the Request for Reconsideration filed on June 28, 2007, JP '966 does not teach what the Examiner asserts. Quite the contrary, JP '966 teaches the opposite. JP '966 does not describe that 'the ripening step can prevent the decrease in the adhesion strength' but suggests that the ripening may cause a decrease in the adhesion strength, but the ripening in an inert atmosphere could prevent the decrease in the adhesion strength. It should be considered that the ripening does not cause the decrease in the adhesion strength but the use of inert gas avoids the occurrence of decrease in the adhesion strength, and still it can merely maintain the adhesion strength at an originally present level. The purpose of ripening in JP '966 is in suppressing the curl, and there cannot be found a suggestion that the ripening increases the adhesion strength. In particular, Example 1 of JP '966 teaches that adhesion strength was reduced by about 20% compared with that prior to heat aging. This teaching would teach away from use of heat aging in Chen et al. or Shiotani et al.

In the Advisory Action dated September 14, 2007 (almost three months after the request for reconsideration after final rejection was filed), the Examiner noted that JP '966 recites a drying-solidification step as well as the ripening step. The Examiner asserted in the Advisory Action that this drying-solidification step would increase adhesion of the polyimide and metal

layer. The Examiner does not explain the basis for this conclusion as it relates to the claimed invention. The Advisory Action further argues that because JP '966 provides sections which do not mention a reduction of adhesion, the failure of the claims to recite a particular increase in adhesion would encompass a small increase.

JP '966 is directed to a method which comprises cast-coating, on a metal foil, a solution of a heat-resistant polymer, a polyimide precursor solution, or a polyester-imide solution, then solidifying the solution via drying, and thereafter executing a ripening for a prolonged period. Thus, instead of directly forming a metal on a thermoplastic polyimide as required by the present claims, JP '966 is directed to forming a plastic layer on a metal foil. As such, the Examiner's position that the drying-solidification step would increase adhesion is misplaced as applied to the present claims. That is, claim 1 requires forming at least one conductor layer directly adhering with at least one surface of a thermoplastic polyimide film to obtain a laminate. In the drying-solidification step of JP '966, a laminate of polyimide layer/conductor layer is yet to be obtained. Even if it is assumed as asserted by the Examiner that there would be some increase of adhesion, the teachings of JP '966 combined with Chen et al. or Shiotani et al. still would fail to teach the claimed invention. In other words, in the drying-solidification step of JP '966, there is yet to be provided a laminate of polyimide layer/conductor layer.

Claim 1 is further distinguished from the cited references by requiring heating said laminate after said laminate is formed so that the adhesion strength between the thermoplastic polyimide film and the conductor layer is enhanced. It is the Examiner's position that because

the claims do not recited a "particular" increase, such would encompass a small increase. As noted above, claim1 requires heating said laminate after said laminate is formed so that the adhesion between the thermoplastic polyimide film and the conductor layer is enhanced. Accordingly, the solidifying/drying step of JP '966 can not read on this step because there is yet to be a laminate (the laminate having a conductor layer directly adhering with at least one surface of a thermoplastic polyimide film). Therefore, the only possible teaching which may be applicable to claimed heating step would have to correspond to the ripening step of JP '966. The ripening step of JP '966 in no way teaches or suggests that adhesion strength is enhanced, but instead teaches away from any increase. Even if it is considered that no reduction in adhesive strength occurs in JP '966, there is still no teaching of an enhanced adhesion strength required by claim 1. Therefore, the combined teachings of the references fail to teach all the limitations required by claim 1.

It should be noted that the teachings of the references all relate to use of a metal foil as opposed to forming at least one conductor layer directly adhering with at least one surface of a thermoplastic polyimide film. For example, Shiotani et al. is directed to a polyimide/metal composite sheet composed of a polyimide substrate film and a metal foil. Similarly, Chen et al. teaches an improved method of laminating a metal foil or sheet to a polyimide material. The only mention of plating appears to be in the discussion of the prior art made by Shiotani et al. at column 1, lines 29 and 30, which mentions that one known method is a metal electrically plated onto a polyimide film. Accordingly, appellants respectfully argue that the combination of the

teachings of the references would not fairly direct one of ordinary skill in the art to form at least one conductor layer directly adhering to at least one surface of a thermoplastic polyimide film to obtain a laminate. That is, a fair reading of the cited art would not have motivated one of ordinary skill in the art to form a conductor layer directly adhering of at least one surface of a thermoplastic polyimide film (for example by plating), following by heating to enhance the adhesion strength. Instead, the teachings of the prior art would motivate one of ordinary skill in the art to employ a metal foil as all of the cited references exemplify. Since the references would have motivated one of ordinary skill in the art to employ a metal foil, the references fail to teach the required limitation of forming at least one conductor layer directly adhering to at least one surface of a thermoplastic polyimide film to form a laminate.

Accordingly, the teachings of Chen et al. or Shiotani et al. combined with JP '966 do not teach or suggest the features of claim 1.

Independent Claim 2

Independent claim 2 is directed to a process for producing a laminate comprising a polyimide, a sheet material and a conductor layer. Independent claim 2 recites similar features to claim 1 in that claim 2 requires forming at least one conductor layer directly adhering to at least one of the thermoplastic polyimide surfaces to obtain a laminate, and heating said laminate so that the adhesion strength between the thermoplastic polyimide and the conductor layer is enhanced. Accordingly, the arguments made with respect to claim 1 above also apply to claim 2.

Claim 2 further requires the features of casting or applying a polyamic acid corresponding to a thermoplastic polyimide to at least one of a sheet material surface, and imidating said polyamic acid to form a polyimide laminate having a thermoplastic polyimide surface. Thus, claim 2 requires formation of a polyimide laminate having a thermoplastic polyimide surface, so as to form at least one conductor layer directly adhering with at least one of the thermoplastic polyimide surfaces.

Shiotani et al. teaches formation of a polyimide/polyimide composite sheet upon which a metal film (metal foil) is fixed (see column 5, lines 44-48) by a hot melt method. Shiotani et al. fails to teach or suggest forming at least one conductor layer directly adhering with at least one of the thermoplastic polyimide surfaces.

Similarly, Chen et al. teaches formation of a thermoplastic polyimide by use of a solution of a precursor applied onto a first film of polyimide, followed by heating to complete imidization (column 3, lines 9-27). Chen et al. teaches that a metal sheet or foil is laminated thereafter onto the thermoplastic polyimide film (column 3, lines 28-30). Thus, Chen et al. does not teach or suggest forming a conductor layer directly adhering with at least one of the thermoplastic polyimide surfaces to obtain a laminate.

JP '966 is directed to a method of cast-coating a solution of a heat-resistant polymer solution on a metal foil and then solidifying via drying to produce a flexible composite sheet. After solidification via drying, JP '966 teaches a ripening step. Thus, like Chen et al. and Shiotani et al., JP '966 fails to provide any teaching or suggestion of forming at least one

conductor layer directly adhering with at least one of the thermoplastic polyimide surfaces to obtain a laminate.

For these reasons, and the reasons discussed above with respect to claim 1, the combination of Chen et al., Shiotani et al. and JP '966 fails to teach or suggest the features of claim 2.

Independent Claim 3

Independent claim 3 is directed to a process for producing a laminate comprising a polyimide, a sheet material and a conductor layer. Independent claim 3 recites similar features to claim 1 in that claim 3 requires forming at least one conductor layer directly adhering with at least one of the thermoplastic polyimide surfaces, and heating said laminate so that the adhesion strength between the thermoplastic polyimide and the conductor layer is enhanced. Accordingly, the arguments made with respect to claim 1 above also apply to claim 3.

Claim 3 further requires the limitation of attaching at least one thermoplastic film to at least one of a sheet material surface to form a polyimide laminate having thermoplastic polyimide surface(s). The teachings of Chen et al., Shiotani et al. and JP '966 fail to teach or suggest the features required by claim 3. In particular, claim 3 requires formation of a polyimide laminate having a thermoplastic polyimide surface(s), and onto which at least one conductor layer is formed directly adhering with at least one of the thermoplastic polyimide surface(s). Because the combination of references fails to teach forming at least one conductor layer directly

adhering with at least one of the thermoplastic polyimide surfaces, the combination would also fail to teach or suggest heating said laminate so that the adhesion strength between the thermoplastic polyimide film and the conductor layer is enhanced.

Independent Claim 17

Independent claim 17 is directed to a process for producing a laminate which comprises dry plating at least one conductor layer directly adhering with at least one surface of a thermoplastic polyimide film to obtain a laminate. None of the cited references teaches or suggests this required feature of claim 17. That is, all of the cited references are directed to processes which employ metal foils. The only mention of plating in the cited references appears to be the one mentioned in the Background of the Invention of Shiotani et al. at column 1, lines 29 and 30 which mentions that it has been known that a metal is electrically plated onto a polyimide film. The invention of Shiotani et al., however, employs a metal foil. Chen et al. and JP '966 also employ metal foils. Accordingly, for at least this reason, the combination of references fails to render claim 17 unpatentable.

Claim 17, however, further requires heating said laminate so that the adhesive strength between the thermoplastic polyimide film and the conductor layer is enhanced. As noted above, the teachings of JP '966 would not have motivated one of ordinary skill in the art to further heat the laminate because such heat aging taught by JP '966 reduces adhesion strength.

Independent Claim 18

Independent claim 18 is directed to a process for producing a laminate. The process comprises providing a thermoplastic polyimide film having at least one surface. The process further requires forming a conductor layer directly adhering with said at least one surface. Claim 18 further requires heating the thermoplastic polyimide film and the formed conductor layer. The combination of references fails to teach or suggest the features required by claim 18.

With respect to providing a thermoplastic polyimide film having at least one surface and forming a conductor layer directly adhering with said at least one surface, it is noted that the Background of the Invention of Shiotani et al. teaches that it was known to electrically plate metal onto a polyimide film. However, Shiotani et al. does not teach or suggest a subsequent step of heating the thermoplastic polyimide film and the formed conductor layer. The teachings of Shiotani et al. would have directed one of ordinary skill in the art away from use of electrically plating. The method of Shiotani et al. would have motivated one of ordinary skill in the art to employ a metal film or metal foil which is fixed onto the polyimide coat of the polyimide/polyimide composite sheet by a hot melt method. Similarly, the teachings of Chen et al. and JP '966 would have motivated one of ordinary skill in the art to employ a metal foil, in contrast to the required step of claim 18 of forming a conductor layer directly adhering with said at least one surface.

Accordingly, the combination of art applied by the Examiner fails to teach or suggest the features required by claim 18.

2. Claims 1, 3-11, 13 and 17-20 are patentable over JP '640 or JP '106 in combination with JP '966.

The combination of references set forth in the rejection fails to raise a prima facie rejection of the claims because the combination does not teach all of the features required by the claims. Furthermore, a combination of the references provides no suggestion which would have rendered the claimed invention obvious.

In JP '640, Examples 1-8 employ a copper foil wherein heat and pressure are applied. Example 9 of JP '640, on the other hand, provides a conductor layer which is directly formed by a chemical plating method. Example 9 of JP '640 does not disclose or suggest that a heating step is performed after chemical plating is conducted. Thus, JP '640 does not teach sputtering or vapor depositing a metal on a thermoplastic polyimide sheet followed by heating. This is clearly evident from Table 1 which does not report a press temperature for Example 9, as compared with the other examples which all report a press temperature when laminating a foil onto a thermoplastic polyimide.

JP '106 merely teaches direct lamination of metal or metal oxide onto a heat resistant film. A reading of the machine translation of JP '106 shows that the drying and heating steps pertain to formation of the polyimide film itself prior to formation of metal or metal oxide. Furthermore, JP '106 discloses a non-thermoplastic polyimide layer, not a thermoplastic

polyimide as required by the present claims. This is evident from the disclosed heat treatment carried out as high as 480°C for four minutes.

As acknowledged by the Examiner, JP '640 and JP '106 each fail to teach heating the laminate. JP '966 was applied for its disclosure of aging to allegedly render the claimed heating step obvious. As noted in the above discussion of JP '966, this teaching is directed to aging of a polyimide which is formed on a metal foil. This teaching would not have motivated one of ordinary skill in the art to modify the teachings of either JP '640 or JP '106 in the manner asserted by the Examiner.

Independent Claim 1

Independent claim 1 requires heating said laminate after said laminate is formed so that the adhesion strength between the thermoplastic polyimide film and the conductor layer is enhanced. Accordingly, the combination of references would not teach or suggest this step. That is, JP '966 does not teach any enhancement of adhesion. The mere fact that JP '966 may not mention a reduction in adhesion strength in some sections does not mean that JP '966 would be considered to describe that adhesion strength is enhanced.

The Examiner argues that it would have been obvious to combine the teachings of references "with the expectation of achieving a superior bond between the polyimide and the metal layers." However, the Examiner's conclusion is not supported by the teachings of the cited references. JP '966 actually teaches that adhesion strength was reduced by about 20% in its

Example 1 compared with that prior to heat aging. In no way would one of ordinary skill in the art expect achieving a superior bond as asserted by the Examiner.

JP '966 is directed to a method which comprises cast-coating, on a metal foil, a solution of a heat-resistant polymer, a polyimide precursor solution, or a polyester-imide solution, then solidifying the solution via drying, and thereafter executing a ripening for a prolonged period. Thus, instead of directly forming a metal on a thermoplastic polyimide as required by the present claims, JP '966 is directed to forming a plastic layer on a metal foil. This teaching would not have motivated one of ordinary skill in the art to modify the teachings of JP '640 or JP '106 to employ a heating step as required by the present claim 1.

Accordingly, claim 1 is patentable over the combination of art applied by the Examiner.

Independent Claim 2

Independent claim 2 is directed to a process for producing a laminate comprising a polyimide, a sheet material and a conductor layer. Independent claim 2 recites similar features to claim 1 in that claim 2 requires forming at least one conductor layer directly adhering to at least one of the thermoplastic polyimide surfaces to obtain a laminate, and heating said laminate so that the adhesion strength between the thermoplastic polyimide and the conductor layer is enhanced. Accordingly, the arguments made with respect to claim 1 above also apply to claim 2.

Claim 2 further requires the features of casting or applying a polyamic acid corresponding to a thermoplastic polyimide to at least one of a sheet material surface, and imidating said

polyamic acid to form a polyimide laminate having a thermoplastic polyimide surface. Thus, claim 2 requires formation of a polyimide laminate having a thermoplastic polyimide surface, so as to form at least one conductor layer directly adhering with at least one of the thermoplastic polyimide surfaces.

As noted above with respect to the argument pertaining to claim 1, JP '640 and JP '106 both fail to teach or suggest a subsequent heating step. Contrary to the assertion of the Examiner, JP '966 would not have motivated one of ordinary skill to modify either JP '640 or JP '106 to perform a subsequent heating step. Even if the references could be combined, the combination would suggest a decrease in adhesion strength, not an enhancement of adhesion as required by claim 2.

Accordingly, the combination of art does not render claim 2 unpatentable.

Independent Claim 3

Independent claim 3 is directed to a process for producing a laminate comprising a polyimide, a sheet material and a conductor layer. Independent claim 3 recites similar features to claim 1 in that claim 3 requires forming at least one conductor layer directly adhering with at least one of the thermoplastic polyimide surfaces, and heating said laminate so that the adhesion strength between the thermoplastic polyimide and the conductor layer is enhanced. Accordingly, the arguments made with respect to claim 1 above also apply to claim 3.

Independent Claim 17

Independent claim 17 is directed to a process for producing a laminate which comprises dry plating at least one conductor layer directly adhering with at least one surface of a thermoplastic polyimide film to obtain a laminate, and heating said laminate so that the adhesive strength between the thermoplastic polyimide film and the conductor layer is enhanced.

As acknowledged by the Examiner, each of JP '640 and JP '106 fails to teach a heating step after a laminate is formed. JP '966 is applied by the Examiner to allegedly render the claimed heating obvious.

As noted above, JP '966 would not have motivated one of ordinary skill in the art to modify the teachings of JP '640 or JP '106 to employ a heating step as claimed. Since JP '640 and JP '106 each form a metal on a polyimide, one of ordinary skill would not look to the teachings of JP '966 which is concerned with formation of polyimide on a metal foil. That is, there is no reason to look to the teachings of JP '966 because a polyimide is already formed in JP '640 or JP '106 when metal is applied. Furthermore, the teaching of JP '966 that a reduction of adhesive strength would be expected does not suggest heating so that adhesive strength is enhanced. Therefore, the combination does not teach or suggest the features of claim 17.

Independent Claim 18

Independent claim 18 is directed to a process for producing a laminate. The process comprises providing a thermoplastic polyimide film having at least one surface. The process

further requires forming a conductor layer directly adhering with said at least one surface. Claim 18 further requires heating the thermoplastic polyimide film and the formed conductor layer. The combination of references fails to teach or suggest the features required by claim 18.

As noted above, there is no reason why one of ordinary skill in the art would look to the teaching of JP '966 when a polyimide has already been formed in the processes of JP '640 and JP '106. Furthermore, there would have been no motivation to look to the teachings of JP '966 as one would expect heating to have an adverse effect on adhesion. Accordingly, claim 18 is patentable over the combination of references,

3. Claim 12 is patentable over JP '640, Chen et al., Shiotani et al. or JP '106 in combination with JP '966 further in combination with Ameen et al.

Claim 12 further recites the feature of increasing the total thickness of the conductor layer a wet plating method. Claim 12 depends from claim 10, which requires that the conductor layer is formed by a dry plating method. Claim 10 depends from any one of claims 1 to 3.

The arguments with respect to the patentability of claims 1-3 are incorporated herein.

As acknowledged by the Examiner, JP '640 and JP '106 each do not teach a heating step as recited in any of claims 1 to 3. The teachings of JP '966 would not have motivated one of ordinary skill in the art to modify JP '640 or JP '106 to employ a heating step after metal is formed on polyimide. Furthermore, there is no teaching or suggestion which would lead one of

ordinary skill in the art to expect an enhancement of adhesion strength because JP '966 does not teach any enhancement of adhesion strength, but instead teaches a reduction.

Similarly, a combination of Chen et al. or Shiotani et al. with JP '966 would not suggest the invention recited in any of claims 1 to 3. None of the references in the combination would motivate one of ordinary skill in the art to form at least one conductor layer directly adhering with at least one surface of a thermoplastic polyimide film to obtain a laminate because each of the references employs metal foil. Furthermore, the teachings of JP '966 do not suggest any enhancement of adhesion strength, but instead teach a reduction.

Ameen et al. fails to provide the teachings which the primary references lack.

Accordingly, the combinations of references do not render claim 12 unpatentable.

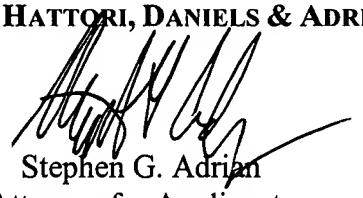
(VIII) CONCLUSION

For the above reasons, the Honorable Board is requested to reverse the rejections of the Examiner.

If this paper is not timely filed, appellants hereby petition for an appropriate extension of time. The fee for any such extension may be charged to Deposit Account No. 50-2866, along with any other additional fees that may be required with respect to this paper.

Respectfully submitted,

WESTERMAN, HATTORI, DANIELS & ADRIAN, LLP



Stephen G. Adrian
Attorney for Applicants
Registration No. 32,878
Telephone: (202) 822-1100
Facsimile: (202) 822-1111

SGA/arf

(IX) CLAIMS APPENDIX

1. (Previously Presented) A process for producing a laminate comprising a polyimide and a conductor layer, which comprises

forming at least one conductor layer directly adhering with at least one surface of a thermoplastic polyimide film to obtain a laminate, and

heating said laminate after said laminate is formed so that the adhesion strength between the thermoplastic polyimide film and the conductor layer is enhanced.

2. (Previously Presented) A process for producing a laminate comprising a polyimide, a sheet material and a conductor layer, which comprises

casting or applying a polyamic acid corresponding to a thermoplastic polyimide to at least one of a sheet material surface,

imidating said polyamic acid to form a polyimide laminate having a thermoplastic polyimide surface,

forming at least one conductor layer directly adhering with at least one of the thermoplastic polyimide surfaces to obtain a laminate, and

heating said laminate so that the adhesion strength between the thermoplastic polyimide and the conductor layer is enhanced.

3. (Previously Presented) A process for producing a laminate comprising a polyimide, a sheet material and a conductor layer comprises

attaching at least one thermoplastic film to at least one of a sheet material surface to form a polyimide laminate having thermoplastic polyimide surface(s),

forming at least one conductor layer directly adhering with at least one of the thermoplastic polyimide surfaces, and

heating said laminate so that the adhesion strength between the thermoplastic polyimide and the conductor layer is enhanced.

4. (Original) The process according to claims 2 or 3, wherein said sheet material is a non-thermoplastic polyimide film.

5. (Original) The process according to any one of claims 1 to 3, wherein the thickness of said conductor layer is from 0.01 to 5 μm.

6. (Original) The process according to any one of claims 1 to 3, wherein the heating temperature is 50°C or higher.

7. (Original) The process according any one of claims 1 to 3, wherein the heating temperature is higher by 30°C or more than the glass transition temperature of the thermoplastic polyimide.

8. (Previously Presented) The process according to any one of claims 1 to 3, wherein said heating step is carried out under pressure.

9. (Original) The process according to claim 8, wherein the pressure at the pressurizing is 1MPa or more.

10. (Previously Presented) The process according to any one of claims 1 to 3, wherein said conductor layer is formed by a dry plating method.

11. (Original) The process according to claim 10, wherein said dry plating method is one selected from a group consisting of sputtering method, vacuum evaporation method, ion plating method and chemical evaporation method.

12. (Original) The process according to claim 10, which further comprises increasing the total thickness of the conductor layer by a wet plating method.

13. (Original) The process according to any one of claims 1 to 3, wherein said conductor layer comprises copper.

14 – 16 (Canceled)

17. (Previously Presented) A process for producing a laminate comprising:

dry plating at least one conductor layer directly adhering with at least one surface of a thermoplastic polyimide film to obtain a laminate, and

heating said laminate so that the adhesive strength between the thermoplastic polyimide film and the conductor layer is enhanced.

18. (Previously Presented) A process producing a laminate comprising:

providing a thermoplastic polyimide film having at least one surface;

forming a conductor layer directly adhering with said at least one surface; and

heating the thermoplastic polyimide film and the formed conductor layer.

19. (Previously Presented) The process according to any one of claims 1 to 3 or 17, wherein said laminate has a peel strength of at least 1.0 N/cm prior said heating.

20. (Previously Presented) The process according to claim 18, wherein said conductor directly adheres with said at least one surface with a peel strength of at least 1.0 N/cm prior to said heating.

(X) EVIDENCE APPENDIX

Declarations of Masaru Nishinaka were filed and entered into the record on July 11, 2003 and on March 2, 2005, providing experimental data in addition to that provided in the specification. The declaration highlights the differences between the present invention and prior art methods. A copy of the declarations is attached to complete the record.

(XI) RELATED PROCEEDINGS APPENDIX

n/a

PATENT APPLICATION

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re application of

Shoji HARA *et al.*

Appln. No.: 09/782,169 Group Art Unit: 1762

Filed: February 14, 2001 Examiner: Brian K. Talbot

For: Laminate Comprising Polyimide and Conductor Layer, Multi-Layer Wiring Board with the Use of the Same and Process for Producing the Same

DECLARATION UNDER 37 C.F.R. §1.132

Assistant Commissioner of Patents
Washington, D.C. 20231

Sir/Madam:

I, Masaru NISHINAKA, do declare and state that:

I graduated from Osaka City University, Faculty of Engineering, Department of Applied Physics, with a degree in Industry, receiving a Master's Degree in March of 1992.

Since April of 1992, I have been employed by KANEKA CORPORATION, where I am engaged in research and development relating to the synthesis of polyimide filmsarticles, the surface treatments, and the metallizing.

I am familiar with the prosecution history of the above-identified application including the Office Action dated February 24, 2003 in the above-identified application.

I am a co-inventor of the invention described and claimed in the above-identified application.

The following experiment was conducted by me or my direct supervision in order to demonstrate the superiority of the present invention.

EXPERIMENTATION

1. Referential Example 3

In the Example 2 in the present specification, a laminate which does not include the thermoplastic polyimide was prepared, and the peel strength thereof was measured.

A 17% by weight solution of a polyamic acid, which had been synthesized by using pyromellitic dianhydride/p-phenylene(trimellitic acid monoester acid anhydride)/p-phenylenediamine/4,4'-diaminodiphenyl ether at a molar ratio of 5/5/4/6, in DMF was defoamed by centrifugation and then cast on an aluminum foil to give a final thickness of 17 μm. This laminate comprising the aluminum foil and the polyamic acid solution was heated to 110°C for 4 minutes to thereby give a self-supporting gel film. This gel film was heated to 150°C, 200°C, 250°C, 300°C and 350°C each for 1 minute to thereby give non-thermoplastic polyimide films of 17 μm in thickness.

These non-thermoplastic films thus obtained were each set on a substrate holder of a magnetron sputtering apparatus HSM-720 (manufactured by Shimadzu Corporation) and the apparatus was evacuated to 4×10^{-4}Pa. Subsequently, Ar gas was blown so that the pressure within the magnetron sputtering apparatus was maintained at 0.6 Pa. In this state, a thin copper film of 0.1 μm in thickness was formed on the film by using a copper target with a DC pour source of a current value of 0.5A. Before the formation of the thin film, pre-sputtering was carried out for 15 minutes. Thus, 3 samples each having a copper thin film formed on a non-thermoplastic film were prepared. Then these samples were cut into pieces of 12 cm x 8 cm and subjected to electrolytic copper

plating by the electrolytic plating method while passing an electric current (2 A) until the conductor thickness attained 20 μm. Each sample was allowed to stand at room temperature for 4 days and then heated at 220°C for 30 minutes.

Subsequently, the copper oxide film formed on the conductor layer surface was eliminated by using a 5% by weight sulfuric acid solution. After applying a circuit tape of 3 mm in width, etching was performed with the use of a cupric chloride solution. After taking off the circuit tape, the sample was dried at 50°C for 30 minutes to give a pattern of 3 mm in width. Next, the peel strength of the pattern of 3 mm in width was determined. The peel strength was measured by pulling in a direction 90° to the polyimide at a speed of 50 mm/min. The peel strength was measured thrice and the average was employed. Table 1 summarizes the measurement results.

2. Referential Example 4

In the Example 4 in the present specification, a laminate which does not include the thermoplastic-polyimide was prepared, and the peel strength thereof was measured.

A 17% by weight solution of a polyamic acid, which had been synthesized by using pyromellitic dianhydride/p-phenylene(trimellitic acid monoester acid anhydride)/p-phenylenediamine/4,4'-diaminodiphenyl ether at a molar ratio of 5/5/4/6, in DMF was defoamed by centrifugation and then cast on an aluminum foil to give a final thickness of 17 μm. This laminate comprising the aluminum foil and the polyamic acid solution was heated to 110°C for 4 minutes to thereby give a self-supporting gel film. This gel film

was heated to 150°C, 200°C, 250°C, 300°C and 350°C each for 1 minute to thereby give non-thermoplastic polyimide films of 17 μm in thickness.

These non-thermoplastic films thus obtained were each set on a substrate holder of a magnetron sputtering apparatus HSM-720 (manufactured by Shimadzu Corporation) and the apparatus was evacuated to 4×10^{-4}Pa. Subsequently, Ar gas was blown so that the pressure within the magnetron sputtering apparatus was maintained at 0.6 Pa. In this state, a thin copper film of 0.3 μm in thickness was formed on the film by using a copper target with a DC pour source of a current value of 0.5A. Before the formation of the thin film, pre-sputtering was carried out for 15 minutes. Thus, 6 samples each having a copper thin film formed on a non-thermoplastic film were prepared. Then these samples were cut into pieces of 12 cm x 8 cm and coated on both faces by using a fluoroplastic film sheet (Niftron manufactured by Nitto Denko Corporation) of 0.2 mm in thickness. Further, both faces of these samples were coated with a rubber sheet of 5 mm in thickness and a ferro-plate. Then these samples were pressed under a pressure of 3 MPa for 10 minutes at the pressing temperature of 220°C.

After surface-washing with a 5% aqueous solution of sulfuric acid for 30 seconds, these samples were subjected to electrolytic copper plating by the electrolytic plating method while passing an electric current (2 A) until the conductor thickness attained 15 μm. Each sample was allowed to stand at room temperature for 4 days. After applying a circuit tape of 3 mm in width, etching was performed with the use of a cupric chloride solution. After taking off the circuit tape, the sample was dried at 50°C for 30 minutes to give a pattern of 3 mm in width. Next, the peel strength of the pattern of 3 mm in width

was determined. The peel strength was measured by pulling in a direction 90° to the polyimide at a speed of 50 mm/min. Table 2 summarizes the measurement results.

[Table 1]

	Process	Heating temp. (°C)	Peel strength (N/cm)
Ex. 2 (a sputtering layer / a thermoplastic polyimide / a non-thermoplastic polyimide)	Spettering → Electroplating → Heating	170	4.2
		220	4.4
Comp. Ex. 2 (a sputtering layer / a thermoplastic polyimide / a non-thermoplastic polyimide)	Spettering → Electroplating	no	1.8
Referential Ex. 1 (a sputtering layer / a non-thermoplastic polyimide)	Spettering → Electroplating	no	1.0
Referential Ex. 3 (a sputtering layer / a non-thermoplastic polyimide)	Spettering → Electroplating → Heating	220	1.1

[Table 2]

	Process	Heating temp. (°C)	Peel strength (N/cm)
Ex. 4 (a sputtering layer / a thermoplastic polyimide / a non-thermoplastic polyimide)	Spettering → Heating and Pressurizing→ Electroplating	170	4.2
		220	5.0
		250	5.6
Comp. Ex. 4 (a sputtering layer / a thermoplastic polyimide / a non-thermoplastic polyimide)	Spettering → Electroplating	no	1.8
Referential Ex. 2 (a sputtering layer / a non-thermoplastic polyimide)	Spettering → Electroplating	no	0.9
Referential Ex. 4 (a sputtering layer / a non-thermoplastic polyimide)	Spettering → Heating and Pressurizing→ Electroplating	220	0.8

Conclusion

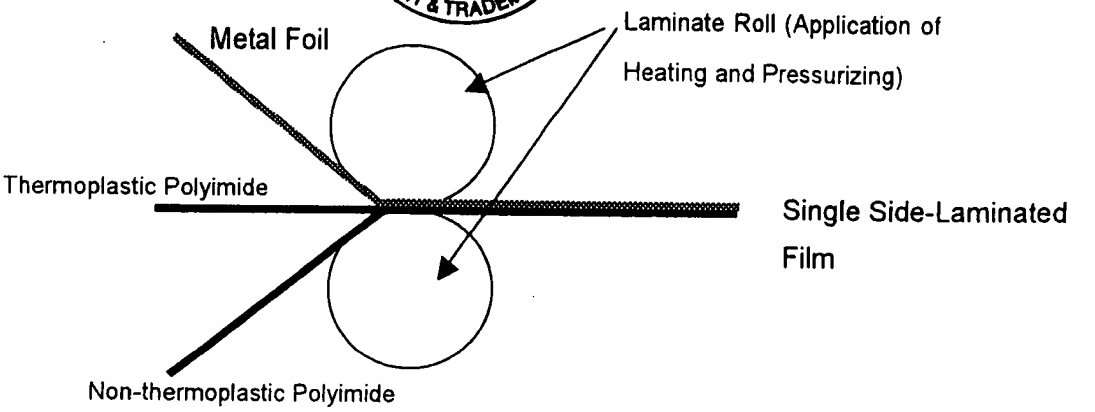
From the results as above, in a laminate wherein a conductor layer was formed directly on a non-thermoplastic polyimide, the improvement of the adhesive strength could not be considered even though heating or heating and pressurizing were conducted.

However, in the present invention, the adhesive strength of the laminate was extremely improved due to the existence of a thermoplastic polyimide and heating treatment.

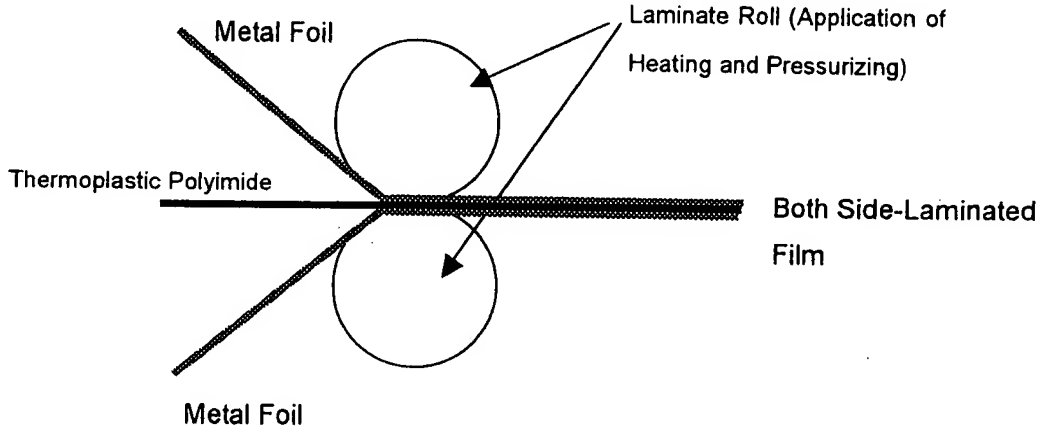
I declare further that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, at Section 1001 of Title 18 of the United States Code and that such willful false statements may jeopardize the validity of the application or any patent issuing thereon.

Date : June 23rd, 2003 Name : Masaru Nishinaka

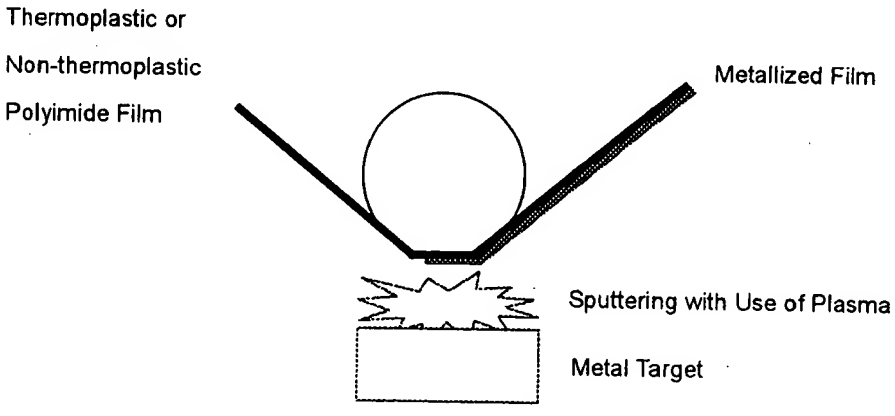
Masaru NISHINAKA



Schematic Illustration of Heat Lamination Method (1)



Schematic Illustration of Heat Lamination Method (2)



Schematic Illustration of Sputtering Method

PATENT APPLICATION

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re application of

Shoji HARA *et al.*

Appln. No.: 09/782,169 Group Art Unit: 1762

Filed: February 14, 2001 Examiner: Brian K. Talbot

For: Laminate Comprising Polyimide and Conductor Layer, Multi-Layer Wiring Board with the Use of the Same and Process for Producing the Same

DECLARATION UNDER 37 C.F.R. §1.132

Commissioner for Patents
Alexandria, VA 22313-1450

Sir/Madam:

I, Masaru NISHINAKA, do declare and state that:

I graduated from Osaka City University, Faculty of Engineering, Department of Applied Physics, with a degree in Industry, receiving a Master's Degree in March of 1992.

Since April of 1992, I have been employed by KANEKA CORPORATION, where I am engaged in research and development relating to the synthesis of polyimide filmsarticles, the surface treatments, and the metallizing.

I am familiar with the prosecution history of the above-identified application including the Office Action dated September 9, 2003 in the above-identified application.

I am a co-inventor of the invention described and claimed in the above-identified application.

The following experiment was conducted by me or my direct supervision in order to demonstrate the superiority of the present invention.

EXPERIMENTATION

1. Example 5 (Vacuum evaporation)

A sample was prepared in the same manner as in Example 4 of the present specification except that copper was vapor deposited in a thickness of 0.2 μm with use of an electron beam-heating type vacuum vapor depositing apparatus (EBH-6, manufactured by ULVAC, Inc.) under the conditions of a degree of vacuum of 1.3×10^{-2} Pa and a film formation rate of 20 Å/sec in place of the sputtering method employed in Example 3.

The pressure and period for the pressurizing and heating treatment were the same as those in Example 3, but the heating temperature for sample preparation was 220°C. Thereafter, a pattern for measuring the peel strength of 3 mm in width was produced in the same manner as in Example 3, and the peel strength was measured to give a value of 4.8 N/cm. Table 1 summarizes the measurement results.

2. Example 6 (Ion plating)

By using an arc discharge type high vacuum ion plating apparatus (AIF-850SB, manufactured by Shinko Seiki Co., Ltd.) instead of the electron beam-heating type vacuum vapor depositing apparatus used in Example 5 as above, a 3.8 μm thick copper layer was formed under the operating condition of a bombarding wattage of 300, an ionization potential of 40 v, an ionization current of 10 A, and an RF50 W, at a film formation rate of 160 Å/sec and a film formation period of 235 sec.

Thereafter, a sample was prepared in the same manner as in Example 5. The peel strength of the resulting sample was measured to give a value of 5.4 N/cm. Table 1 summarizes the measurement results.

Table 1

	Process	Heating Temp (°C)	Peel Strength (N/cm)
Example 2 (laminate of a thermoplastic polyimide and a non-thermoplastic polyimide)	Sputtering → Electroplating → Heating	170	4.2
		220	4.4
Example 4 (laminate of a thermoplastic polyimide and a non-thermoplastic polyimide)	Sputtering → Heating and pressurizing → Electroplating	220	5.0
		250	5.6
Example 5 (laminate of a thermoplastic polyimide and a non-thermoplastic polyimide)	Vacuum Vapor Deposition → Heating and pressurizing → Electroplating	220	4.8
Example 6 (laminate of a thermoplastic polyimide and a non-thermoplastic polyimide)	Ion Plating → Heating and pressurizing → Electroplating	220	5.4
Comparative Example 4 (laminate of a thermoplastic polyimide and a non-thermoplastic polyimide)	Sputtering → Electroplating	None	1.8

Conclusion

From the results as above, in the present invention, the adhesive strength of the laminate was extremely improved due to the existence of a thermoplastic polyimide and heating treatment, in accordance with a vapor evaporation method, ion plating method as well as a sputtering method.

I declare further that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, at Section 1001 of Title 18 of the United States Code and that such willful false statements may jeopardize the validity of the application or any patent issuing thereon.

Date : September 9th, 2004 Name : Masaru Nishinaka

Masaru NISHINAKA